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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)



Applicant's or agent's file reference 11056P5 WO/JCM		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/02938	International filing date (day/month/year) 08.07.2003	Priority date (day/month/year) 15.07.2002	
International Patent Classification (IPC) or both national classification and IPC A01N25/20			
Applicant RECKITT BENCKISER (AUSTRALIA) PTY LIMITED			

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 10 sheets.

- This report contains indications relating to the following items:
 - ☒ Basis of the opinion
 - ☐ Priority
 - ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - ☐ Lack of unity of invention
 - ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - ☐ Certain documents cited
 - ☐ Certain defects in the international application
 - ☐ Certain observations on the international application

Date of submission of the demand 09.02.2004	Date of completion of this report 08.10.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Molina de Alba, J Telephone No. +49 89 2399-7823 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB 03/02938

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*

Description, Pages

1, 2, 4, 5, 8, 9 as originally filed
3, 6, 7, 10, 11 received on 11.08.2004 with letter of 09.08.2004

Claims, Numbers

1-47 received on 11.08.2004 with letter of 09.08.2004

Drawings, Sheets

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

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EXAMINATION REPORT**

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-47
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-47
Industrial applicability (IA)	Yes: Claims	1-47
	No: Claims	

2. Citations and explanations

see separate sheet

1) Reference is made to the following document:

D1: CH 295 917 A (GEIGY AG J R) 31 January 1954 (1954-01-31)

2) The present application relates to moulded combustible products that emanate a pesticide into the atmosphere, undergoing combustion for a prolonged period, thereby providing an extended time period of pesticidal activity. The application particularly relates to mosquito coils.

3) Re Item V

3.1 Novelty (Art. 33(2) PCT)

None of the cited documents discloses a combustible pesticidal product or a method for the preparation thereof as presently claimed. The subject-matter of claims 1-47 is therefore regarded as novel.

3.2 Inventive Step (Art. 33(3) PCT)

Document **D1**, which is considered to represent the closest state of the art, relates to (cf. col. 1 and examples) the preparation of moulded combustible insecticidal coils containing an insecticide (e.g. pyrethrin), starch, cellulose and an alkali nitrate. The use of cellulose and starch instead of wood-dust and cereal flour improves elasticity and resistance to breakability of the coil and diminishes the bad smell of the smoke generated.

The subject-matter of independent claims 1 and 46 differs from **D1** in that the combustible pesticidal product is vacuum moulded (and not simply moulded) and in that it has a draft angle of 5-10 degrees. As indicated on pg. 5, l. 21-23, moulded pulp products commonly have a draft angle of 5-10 degrees in order to aid transfer of the product from the mould. This feature cannot therefore constitute a basis of an inventive step with regard to **D1**. Considering the fact that the claimed product is vacuum moulded, the problem to be solved by the present application may be regarded as providing a product with **higher resistance to breakability**. It seems obvious for the skilled person that a moulding process wherein vacuum is applied will result in a product with better physical properties such as density, homogeneity, compactness, and resistance to breakability. The subject-matter of independent claims 1 and 46 cannot be therefore regarded as inventive. Neither can the subject-matter of the dependent claims, which merely provide technical features within the scope of the customary practice followed by persons skilled in the art.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB 03/02938

3.3 Industrial applicability (Art. 33(4) PCT)

Is acknowledged for the whole set of claims.

avoid breakage. Again it must be emphasised that any breakage of a coil effectively results in a coil being shortened both in length and most significantly, burn time.

Another known method of making mosquito coils is by treating thick pieces of cardboard with an insecticide. The cardboard may be made of layers of thinner sheets which are stacked on top of one another until the desired thickness is achieved. The multi-layered cardboard is then cut to the required shape of the coil. While this method reduces the breakage of the coil, the cutting of the thick cardboard results in the damage and breakage of the cutting knives. The costs associated with the regular replacement of the knives is significant.

Whilst recognising the short comings of traditional mosquito coils, the present inventors have sought to provide an improved coil which is capable of providing a prolonged effective period of insecticidal coverage and is produced in a manner resulting in a cost effective product relative to the traditional coil.

This has been achieved by recognising that rather than forming the coils as planar helices which need to be handled with some care, the coils are moulded to a form which significantly reduces the chance of breakage and does not involve cutting thick cardboard.

Disclosure of Invention

Accordingly, in a first aspect the present invention consists in a combustible pesticidal product comprising a structural element having a thickness defined by sides which slope at an angle of from 5 to 10 degrees and formed of a vacuum moulded pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof, the product including one or more pesticides, which product on combustion emanates the pesticide into the atmosphere.

In a second aspect, the present invention consists in a method of making a combustible pesticidal product comprising the steps of:

forming a pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof,

the addition of one or more pesticides, and

moulding the product by vacuum moulding to form a combustible pesticidal product.

charcoal powder, sawdust, cotton, cloths, rags, and husks of materials such as rice, wheat and coconuts. Preferably, old newspaper is used.

Whilst this invention is applicable to a variety of pesticidal substances, the preferred form relates to the use of insecticides, particularly insecticides that are
5 effective against mosquitoes.

The insecticides used in this invention comprise all residual insecticides, including non-microencapsulated insecticides, microencapsulated insecticides as well as mixtures of non-microencapsulated and microencapsulated insecticides.

It is preferred that the one or more insecticides comprise substances which are
10 toxic to mosquitoes. Without limitation, these include esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin, pyrethrins, citronella, pyrethroids, neem oil and mixtures thereof. When esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin, pyrethrins, and mixtures thereof are used, typically they will be in an amount of from 0.01 to 0.6 % w/w, preferably to 0.02 to 0.3 % w/w, most
15 preferably 0.04 to 0.1 % w/w. When pyrethroids, neem oil, citronella and mixtures thereof are used, typically they will be in an amount of from 0.01 to 10 % w/w, preferably to 0.01 to 6 % w/w, most preferably 0.04 to 6 % w/w.

Emanation of the pesticide into the atmosphere occurs as a result of the pesticide being volatilised as the coil burns. At the front or tip of combustion of a coil, the
20 temperature may be 200-500°C. However, behind the tip, the temperature will be somewhat lower owing to the insulation properties of the pulp. This means that compounds such as esbiothrin which boil at 160-170°C will be volatilised and released into the atmosphere behind the burning tip.

The pulp may include an accelerant, being an alkali or alkali earth metal nitrate
25 or nitrite in an amount of from 0.04 to 1.83 % w/w. Preferably, the alkali or alkali earth metal nitrate or nitrite will be included in an amount of from 0.20 to 1.20 % w/w, most preferably about 1.11 % w/w. The nitrates or nitrites that may be used include sodium, potassium, calcium, magnesium and mixtures thereof. It is preferred to utilise potassium as the nitrate or the nitrite, preferably as the nitrate.

30 As an alternative to the alkali or alkali earth metal nitrate or nitrite, the pulp may include an alkali or alkali earth carbonate or bicarbonate in an amount of from 0.02 to

1.83 % w/w. Preferably the alkali or alkali earth metal carbonate or bicarbonate will be included in an amount of from 0.10 to 1.00 % w/w, most preferably about 0.82 % w/w. The carbonates or bicarbonates that may be used include sodium, potassium, calcium, magnesium and mixtures thereof.

5 It is preferred to use potassium carbonate.

Sodium silicate may be included in the pulp in an amount of from 0.01 to 1.37 % w/w. Preferably, the sodium silicate may be included in an amount of from 0.10 to 0.70 % w/w, most preferably about 0.56 % w/w.

A phosphate in an amount of from 0.01 to 0.40 % w/w and selected from the
10 group consisting of diammonium phosphate, monoammonium phosphate, triammonium phosphate and mixtures thereof may be included in the pulp. Preferably the phosphate may be included in an amount of from 0.02 to 0.40 % w/w, most preferably about 0.14 % w/w. Furthermore, of these phosphates, diammonium phosphate is preferred.

A boron compound in an amount of from 0.01 to 0.92 % w/w and selected from
15 the group consisting of boric acid, sodium tetraborate hydrous, sodium borate, potassium borate, calcium borate, zinc perborate, boronatrocalcite and mixtures thereof may be included in the pulp. Preferably the boron compound may be included in an amount of from 0.10 to 0.70 % w/w, most preferably about 0.66 % w/w. Furthermore, of these boron compounds, sodium borate is preferred.

20 It is within the scope of this invention to include a perfume and/or a dye. Both the perfume and the dye, if included, will be selected on the basis of satisfying specific organoleptic requirements. It will of course be appreciated that the perfume must be suitably stable under the conditions of combustion of the coil.

The thickness and width of the pulp are of great importance in determining the
25 burn rate of the coil. It is desired to have a coil which has a low burn rate as less mass is required in the coil. In a preferred embodiment, the structural element is made from moulded pulp, with dimensions of 3-10mm wide by 1-6mm thick, preferably 6mm wide and 4mm thick. The desired length is from 500 to 1500mm, preferably 1100mm. The cross-sectional combustion area is shaped in a rectangle, triangle, square, half-
30 circle, u section or combinations thereof. Where the coil is a single helical coil, the weight of the single coil is 8 to 20 grams, preferably 12 grams.

Figure 2 is a graph showing the effect of width on burn rate of three different products with a density of $450 \pm 50 \text{ kg/m}^3$.

In order to better understand the nature of the invention, a number of examples will now be described.

5 Example 1

Trials were conducted to compare the effect on burn rate when the thickness, width and density of the strips were altered. Strips were produced of lengths between 4-9mm,

with a thickness of 2,3,4 and 5mm at densities of 300,450 and 600kg/m³. These strips were then burnt to determine their mass burn rate in g/h.

Figure 1 shows the effect of varying thickness and widths on burn rate.

The observed trends were that increasing width increases burn rate, and increasing
5 thickness increases burn rate.

Figure 2 shows the effect on the burn rate of the product with a density of 450 ± 50kg/m³ when an accelerant (KNO₃) is added to newspaper pulp and also when using white office paper instead of old newspaper as the main ingredient.

Example 2

- 10 Trials were conducted to compare the effect on burn rate when white office paper was used as the main ingredient and also when the accelerant potassium nitrate (KNO₃) was used with old newspaper. KNO₃ was added at a concentration of 0.125% in the pulp solution. Figure 2 shows that using white office paper as a raw material increases the burn rate dramatically. Likewise the addition of KNO₃ to old newspaper slightly
15 increases the burn rate compared to old newspaper with no additives.

CLAIMS:

1. A combustible pesticidal product comprising a structural element having a thickness defined by sides which slope at an angle of from 5 to 10 degrees and formed of a vacuum moulded pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof, the product including one or more pesticides, which product on combustion emanates the pesticide into the atmosphere.
2. A combustible pesticidal product as in claim 1 wherein the product is formed of a thermoformed pulp.
- 10 3. A combustible pesticidal product as in claim 2 wherein the product is thermoformed at a temperature of between 80 to 400°C, and at a pressure of between 50 to 1500kPa.
4. A combustible pesticidal product of claim 3 wherein the product is thermoformed at a temperature of 250°C.
- 15 5. A combustible pesticidal product of claim 3 wherein the product is thermoformed at a pressure of between 200 to 600kPa.
6. A combustible pesticidal product of claim 4 wherein the product is thermoformed at a pressure of 400kPa.
7. A combustible pesticidal product as in any one of the preceding claims wherein the product comprises either incorporating into the wet pulp during its preparation and/or applying to a pulp as a coating thereof at least one of the following:
an alkali or alkali earth metal nitrate or nitrite in an amount of from 0.04 to 1.83% w/w,
an alkali or alkali earth carbonate or bicarbonate in an amount of from 0.01 to 1.00% w/w;
25 sodium silicate in an amount of from 0.01 to 1.37% w/w;
a phosphate in an amount of from 0.01 to 0.40% w/w and selected from the group consisting of diammonium phosphate, monoammonium phosphate, triammonium phosphate and mixtures thereof;
a boron compound in an amount of from 0.01 to 0.92% w/w and selected from the group consisting of boric acid, sodium tetraborate hydrous, sodium borate, potassium
30

borate, calcium borate, zinc perborate, boronatrocalcite and mixtures thereof; and optionally

a perfume and/or dye.

8. Combustible pesticidal product as claimed in claim 1 in which the one or more pesticides are insecticides, preferably pyrethroids including, esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin and pyrethrins, citronella, neem oil and mixtures thereof.
9. A combustible pesticidal product as claimed in claim 8 wherein the one or more pesticides are selected from the group consisting of pyrethroids including esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin and pyrethrins, citronella, neem oil and mixtures thereof and are in an amount of from 0.01 to 0.6% w/w.
10. A combustible pesticidal product of claim 9 wherein the pesticides are present in an amount of from 0.02 to 0.3% w/w.
11. A combustible pesticidal product of claim 10 wherein the pesticides are present in an amount of from 0.04 to 0.1% w/w.
12. A combustible pesticidal product as claimed in claim 8 wherein the one or more pesticides are insecticides selected from the group consisting of pyrethroids, neem oil, citronella and mixtures thereof and are in an amount of from 0.01 to 10% w/w.
13. A combustible pesticidal product of claim 12 wherein the insecticides are present in an amount of from 0.01 to 6% w/w.
14. A combustible pesticidal product of claim 13 wherein the insecticides are present in an amount of from 0.04 to 6% w/w.
15. A combustible pesticidal product as in any one of claims 7 to 14 wherein the alkali earth metal nitrate or nitrite is included in an amount of from 0.20 to 1.20% w/w.
16. A combustible pesticidal product of claim 15 wherein the alkali earth metal nitrate or nitrite is included in an amount of 1.11% w/w.
17. A combustible pesticidal product as in any one of claims 7 to 15 wherein the nitrates and nitrites are selected from the group consisting of sodium nitrite, sodium nitrate, potassium nitrite, potassium nitrate, calcium nitrite, calcium nitrate, magnesium nitrite, magnesium nitrate and mixtures thereof.

18. A combustible pesticidal product of claim 17 wherein the alkali or alkali earth metal carbonate or bicarbonate is present in an amount of about 0.82% w/w.
19. A combustible pesticidal product as in claim 17 wherein the carbonates or bicarbonates are selected from the group consisting of sodium carbonate, sodium bicarbonate, potassium carbonate, potassium bicarbonate, calcium carbonate, calcium bicarbonate, magnesium bicarbonate, magnesium carbonate and mixtures thereof.
20. A combustible pesticidal product as in any one of claims 7 to 19 wherein the sodium silicate is included in an amount of from 0.01 to 0.70% w/w.
21. A combustible pesticidal product of claim 20 wherein the sodium silicate is included in an amount of about 0.56% w/w.
22. A combustible pesticidal product as in any one of claims 7 to 21 wherein the phosphate is included in an amount of from 0.02 to 0.40% w/w.
23. A combustible pesticidal product of claim 22 wherein the phosphate is included in an amount of 0.14% w/w.
24. A combustible pesticidal product as in claim 22 wherein the phosphate is diammonium phosphate.
25. A combustible pesticidal product as in any one of claims 7 to 24 wherein the boron compound is included in an amount of from 0.10 to 0.70% w/w.
26. A combustible pesticidal product as in claim 25 wherein the boron compound is included in an amount of 0.66% w/w.
27. A combustible pesticidal product as in any one of the preceding claims wherein the thickness of the pulp product is from 1mm to 6mm.
28. A combustible pesticidal product as in claim 27 wherein the thickness of the pulp product is 4mm.
29. A combustible pesticidal product as in any one of the preceding claims wherein the width of the pulp product is from 3mm to 10mm.
30. A combustible pesticidal product as in claim 29 wherein the width of the pulp product is 6mm.
31. A combustible pesticidal product as in any one of the preceding claims wherein the length of the pulp product is from 500 to 1500mm.

32. A combustible pesticidal product as in claim 31 wherein the length of the pulp product is 1100mm.
33. A combustible pesticidal product as in any one of the preceding claims wherein the density of the pulp product is from 300 to 1000kg/m³.
- 5 34. A combustible pesticidal product as in claim 33 wherein the density of the pulp product is from 400 to 600kg/m³.
35. A combustible pesticidal product as in claim 34 wherein the density of the pulp product is 600kg/m³.
36. A combustible pesticidal product as in any one of the preceding claims wherein
10 the product has a cross-sectional combustion area shaped in a rectangle, triangle, square, half-circle, u section or combinations thereof.
37. A combustible pesticidal product as in any one of the preceding claims wherein the organic fibrous materials, cellulose fibres and wood free fibres include but are not limited to waste paper and cardboard, old newspaper, kraft pulp, coconut powder,
15 straw, bagasse, bamboo, cane, straw, grasses, weeds, tea leaves, charcoal powder, sawdust, cotton, cloth and rags, and husks of materials including rice, wheat and coconuts.
38. A combustible pesticidal product as claim 7 wherein the coating is applied to the pulp by rolling, painting, printing or spraying.
- 20 39. A combustible pesticidal product as in any one of the preceding claims wherein other components are added to the pulp or applied as a coating.
40. A combustible pesticidal product as in claim 39 wherein the components can include binders, dewatering agents, chemicals to increase the wet and dry strength of the product, starches, gums, talc and glues.
- 25 41. A combustible pesticidal product as in any one of the preceding claims wherein the product is a mosquito coil having a burn time of at least 4 hours.
42. A combustible pesticidal product as in claim 41 wherein the mosquito coil has a burn time of 7-8 hours.
43. A combustible pesticidal product as in claim 41 wherein the coil is shaped as a
30 single helical coil, double coil, triangular, hexagon, polygon or rectangular.

44. A combustible pesticidal product as in claim 43 wherein the coil is a single helical coil and the weight of the single coil is 8 to 20 grams.

45. A combustible pesticidal product as in claim 44 wherein the weight of the single coil is 12 grams.

5 46. A method of making a combustible pesticidal product comprising the steps of:
forming a pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof,
the addition of one or more pesticides, and
moulding the product by vacuum moulding
10 to form a combustible pesticidal product.

47. A method of making a combustible pesticidal product as in claim 46 wherein the product is formed at a vacuum pressure of 0-20kPa.